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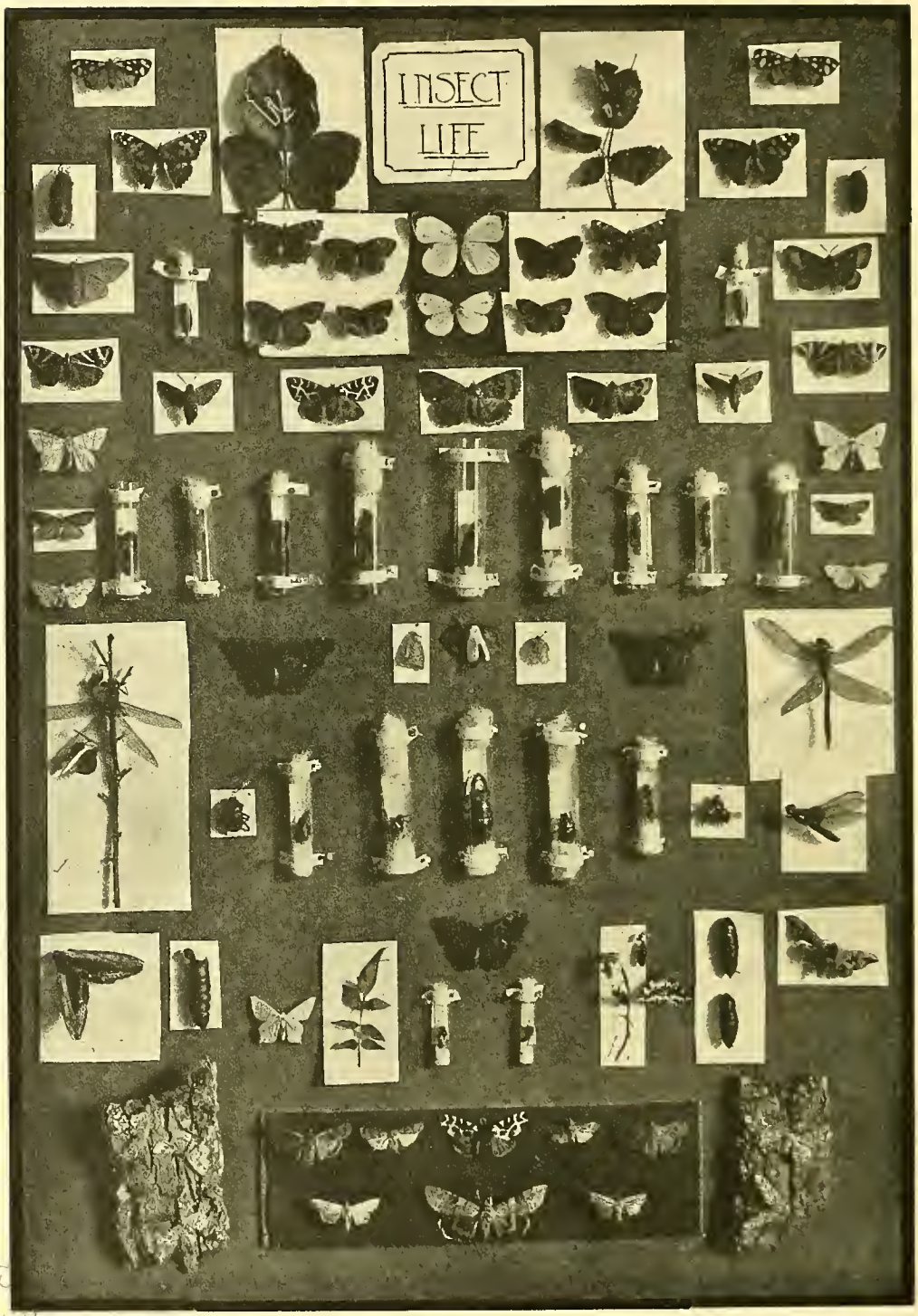
NATURE STUDY
AND
BRUSH DRAWING



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INSECT LIFE

(*See "Collecting and Preserving Specimens," page 59*).

NATURE STUDY

AND

BRUSH DRAWING

CORRELATED ON
HEURISTIC LINES

BY

W. FRANCIS RANKINE

4062.46

8769

CASSELL AND COMPANY, LIMITED
LONDON, PARIS, NEW YORK, TORONTO AND MELBOURNE
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INTRODUCTION

The study of Nature as a part of the school curriculum provides pre-eminently a means of advancement to knowledge through accurate observation and correct reasoning. It is the link between the mind of the scholar and the wide realm of Nature which presents a limitless store of material for observation. This prompts the spirit of research which leads to discovery—a most valuable constructive agent in the education of the individual.

The ruling idea of these pages is to arrange phenomena in logical sequence and to proceed in their treatment as far as possible on heuristic lines. To this end much detail is suppressed and technicalities are omitted. The scheme is not intended to be exhaustive, but will be naturally extended by the teacher to meet his particular requirements.

The need of suitable records has induced the writer to adopt the brush as a ready medium in representing natural form accurately and rapidly. The subjects are drawn in outline or mass according to the nature of the form to be represented. The brush drawing is strictly auxiliary to the Nature Study matter, hence no attention is given to design. Therein, however, lies the possibility of correlating Nature Study with the Drawing Lesson.

The entire object of the scheme is to secure conditions that will make it easy for the student to think for himself. The spirit of collecting specimens is utilised to this end, but it must be followed by systematic classification in order to preserve the perspective of heuristic method.

W. F. R.

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PART I.—PLANT LIFE

1. THE SEED

Specimens required :—Seeds of Broad Bean, Pea, Scarlet Runner Bean, etc.

Structure

Obtain specimens of large seeds—*e.g.* Broad Bean. Soak these in water and examine them after two days. Note the swollen condition of seed due to absorption of water. Distinguish the stem scar (hilum). Squeeze the seed between the fingers, and note that water is discharged through the micropyle. Remove the seed coat (testa) and note the two seed lobes and embryo root (radicle) and stem (plumule). Similarly examine seeds of Pea. Make drawings indicating the structure of seeds examined.

Germination

Sow several kinds of seeds—a few in the garden plot and others in sand, fine soil, or moistened sawdust. Note the swelling of seed and growth of radicle and plumule.

Note by measurement the amount of growth made by both radicle and plumule. Observe the mode of growth of the plumule. The seed leaves appear (note the function of these). Finally the foliage leaves are seen.

Record observations by making sketches of seedlings in various stages of growth. Determine the period of germination, noting carefully the conditions under which germination takes place.

Conditions of Germination

Take several seeds and divide them into three groups. Place—

1st group in ice,
2nd group in dried sand,
3rd group in soil, and place in darkness.

Note results and determine conditions necessary to germination—air, warmth, moisture, light. Observe that, although seeds will grow in darkness, light is essential to healthy growth.

The Seed - Germination.

Type - Broad Bean

Fig. 1

Section of seed.

Fig. 2.

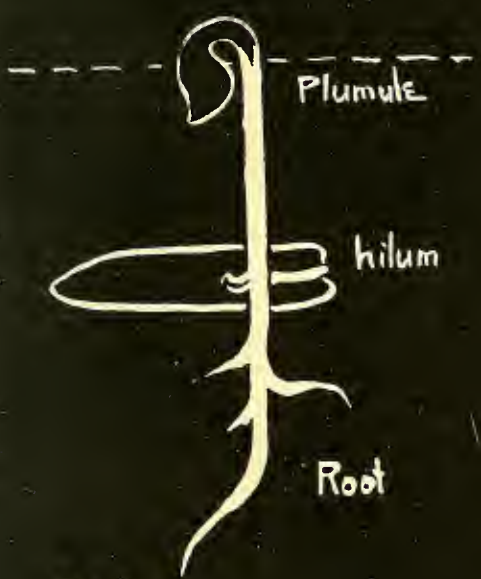


Fig 3

Fig 4.

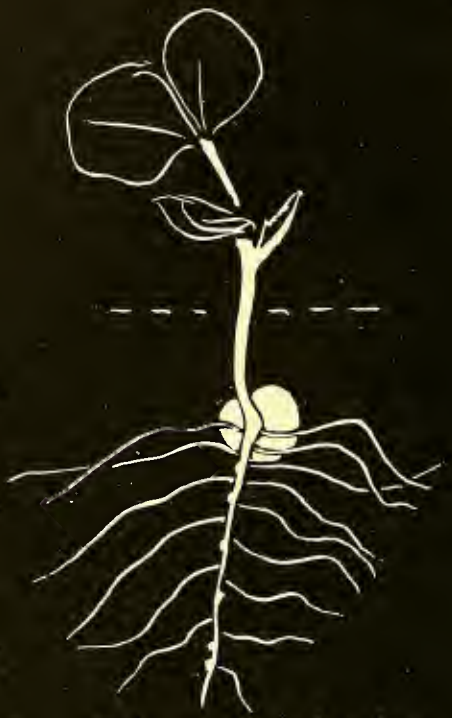
Sketches illustrating parts of seed and stages of germination

PLANT LIFE - THE ROOT.

Cress seedling

Mustard seedling

Root cap and hairs



Pea plant showing roots and nodules.

Fibrous roots of couch grass

Carrot

Turnip

Wild carrot

Tap root

Types of Fleshy roots

II. THE ROOT

Specimens required :—Seedlings of Cress; Roots of Cabbage, Couch Grass, Radish, Dandelion, and Broad Bean

Structure

Examine under lens the roots of seedlings. Note the long rootlet with its small secondary roots (root hairs) and root cap. (*N.B.*—Duckweed shows the root cap clearly.) Note function of root cap. Similarly examine the fibrous roots of grass. Note in case of Couch Grass the real roots at intervals along underground stems.

Examine a Radish root, noting root hairs and fleshy storage of food at base of stem. If possible, compare this with a Radish plant that has run to seed. Note the wasted fleshy root, showing that food storage has been used up by the seeded plant.

Examine Dandelion root system, noting the long tap root. Collect other examples and examine similarly.

Functions of Root

1. One function of roots is obviously to fix the plant firmly in its situation. Note characters of roots of large plants, shrubs, and trees. Distinguish between surface feeders (*e.g.* Grass) and deep feeders (*e.g.* Currant).

2. Immerse roots of seedling of Broad Bean in solution containing red ink. Allow it to stand, and then make sections through root. Note that roots absorb dissolved food and pass it upwards to the plant.

Note roots of Pea and Dwarf Bean with their nitrogen nodules. These contain bacteria, which store nitrogenous food. Collect other examples (*e.g.* all members of Pea family).

Collect roots and classify according to characters of shape.

Note.—Nitrogen nodules are splendidly developed in Lupine.

III. THE LEAF

Specimens required :—Leaves of Laurel, Holly, Apple, Ivy, etc.

Structure

Examine specimen leaves, noting leaf blade, leaf stalk, leaf base. Note sheath at base in Wild Arum.

(*a*) *Venation.*—Examine network of veins in Laurel. Note the mid-rib. Prepare skeleton leaves by immersing in water containing chloride of lime for several days. Compare this system of venation with that of the grasses (parallel venation).

(*b*) *Serration.*—Examine the margin of an Apple leaf. Note serration. Obtain various leaves and make drawings of the various types of serration.

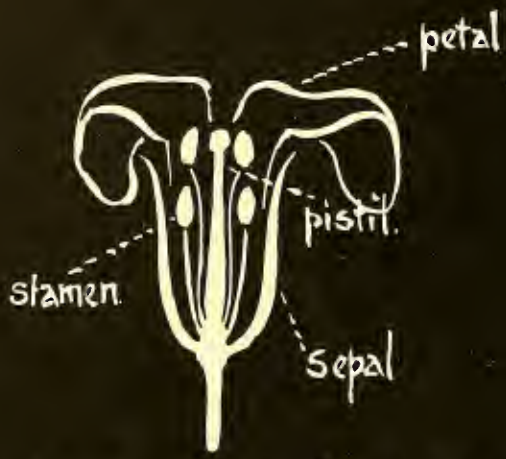
(*c*) *Stomata.*—Tear the outer skin from a Laurel leaf and examine under microscope. Note the pores (stomata) and guard cells. Note the function of these organs.

(*d*) *Etiolation.*—Grow any plant in darkness and note the colour of its leaves. They are bleached through the absence of light. Note reason for earthing up potatoes and celery. Refer to conditions of germination in lesson on the Seed.

Collect various leaves and classify according to shape. Press and dry specimens and mount on paper.

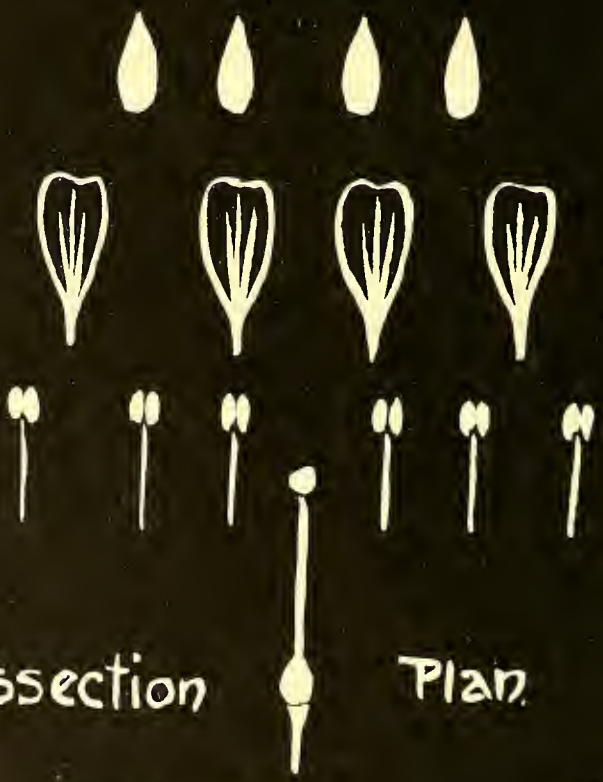
PLANT LIFE - THE LEAF

PLANT LIFE. THE FLOWER



Sectional diagram.

Floral diagram.



Dissection Plan.

WALLFLOWER CRUCIFERAE

IV. THE FLOWER

Specimens required :—Flowers of Wallflower, Herb Robert, Buttercup, etc.

Structure

Examine a blossom of the Wallflower. Note the following points :—

(*a*) Sepals (number, colour, united or free), forming calyx.

(*b*) Petals (number, shape, colour, united or free), forming corolla.

(*c*) Stamens (number, shape, position), pollen.

(*d*) Pistil with ovary at base.

Also observe :—

(1) The function of the calyx.

(2) Cross arrangement of petals.

(3) Structure of stamens, filament, and anthers.

Make section through flower, distinguishing the parts named. Proceed similarly with other flowers, drawing sections for record.

Floral Diagrams

The flower consists of four series of floral organs—*viz.* calyx, corolla, stamens, pistil. Thus the flower may be represented in diagram by four series of lines—*viz.* a central mark to represent pistil, a circle of marks to indicate stamens, another circle of lines to show petals, and an outer circle to represent the sepals. Such a diagram represents the floral organs in number and position.

Note.—The Wallflower as a type of the Cruciferae introduces the study of many common members of that family.

V. THE FRUIT

Specimens required :—Seeds of Poppy, Wallflower, Pea, Bean, Broom, Blackberry, Columbine, Hazel, Buttercup, Wild Geranium, Currant, and Cherry

Structure

Examine these seeds and seed cases. Note the function of seed cases.

Classification

Divide the fruits into two groups—*viz.* :—

- Group A.—Fruits with succulent (juicy) seed cases—*e.g.* Blackberry.
- Group B.—Fruits with dry seed cases—*e.g.* Pea.

Group A—viz. Blackberry, Currant, Cherry. *Note :*—

(*a*) Cherry.—One seed in case, drupe.

(*b*) Blackberry.—A collection of drupes.

(*c*) Currant.—A berry.

Group B—viz. Poppy, Wallflower, Pea, Bean, Broom, Buttercup, Columbine, Hazel.

Divide Group B into two smaller groups :—

Group I.—Containing seed-cases which open when seeds ripen —*e.g.* Pea, Bean, Broom.

Group II.—Containing seed cases which do not open—*e.g.* Hazel, Buttercup, Geranium.

Examine each. *Note :*—

Group B
- *Group I.*—(*a*) Pea.—Seeds in one vessel.
  (*b*) Wallflower.—Seeds in two vessels.
  (*c*) Poppy.—Seeds in many vessels.
- *Group II.* (*a*) Buttercup.—One seed in each vessel.
  (*b*) Wild Geranium.—Many seeds in each vessel.

Collect other examples and classify according to their structures.

PLANT LIFE — THE FRUIT

Capsule of Poppy

Capsule of Autumn Crocus
3 carpels

Silique of Wallflower

Drupe of
Raspberry

Winged seed
of Elm

Winged seed
of Pine

Winged seed of
Sycamore

Pappus of
Thistle

Types of seed & seed cases

THE PLANT

LORDS & LADIES
(Arum maculatum)

lew corm showing roots

Section
Stem

Spadix
FLOWERS
hairs
staminate flowers
hairs
carpellate flowers

New corm
on
old corm

The leaves are heart shaped and protected in spring by long sheaths

The flowers are arranged on a club shaped spike protected by a spathe

The fruit is poisonous – the bright scarlet berries are seen in autumn.

The roots grow out from a corm
A new corm forms each year

VI. DESCRIPTION OF PLANT—Wild Arum

(*Arum maculatum*)

Specimens required :—Plants of Wild Arum

Examine plant as follows :—

1. *Root system.*—A ring of fibrous roots growing from the corm.
2. *Stem.*—Note the corm forming on growth of previous year. Cut through and note wasting of the old corm. Test with iodine for starch. Observe the white fleshy stems and sheathing process of leaves.
3. *Leaves.*—Hastate, dark green, spotted with purplish brown.
4. *Flower.*—The spadix is enveloped in a spathe. Also the spadix is coloured, and incomplete flowers appear at its base. Note fertilisation by insects.
5. *Fruit.*—This is composed of bright scarlet berries which are extremely poisonous. These are conspicuous in autumn.
6. *Habitat.*—Hedges and woods.

Make cross sections of stem. Draw diagrams of parts examined.

Examine in similar way the following :—

Wild Hyacinth, Daffodil, Iris, Orchid, Buttercup.
Poppy, Wallflower, Campion, Herb Robert.

VII. DESCRIPTION OF PLANT—The Dandelion

(*Taraxacum officinale*)

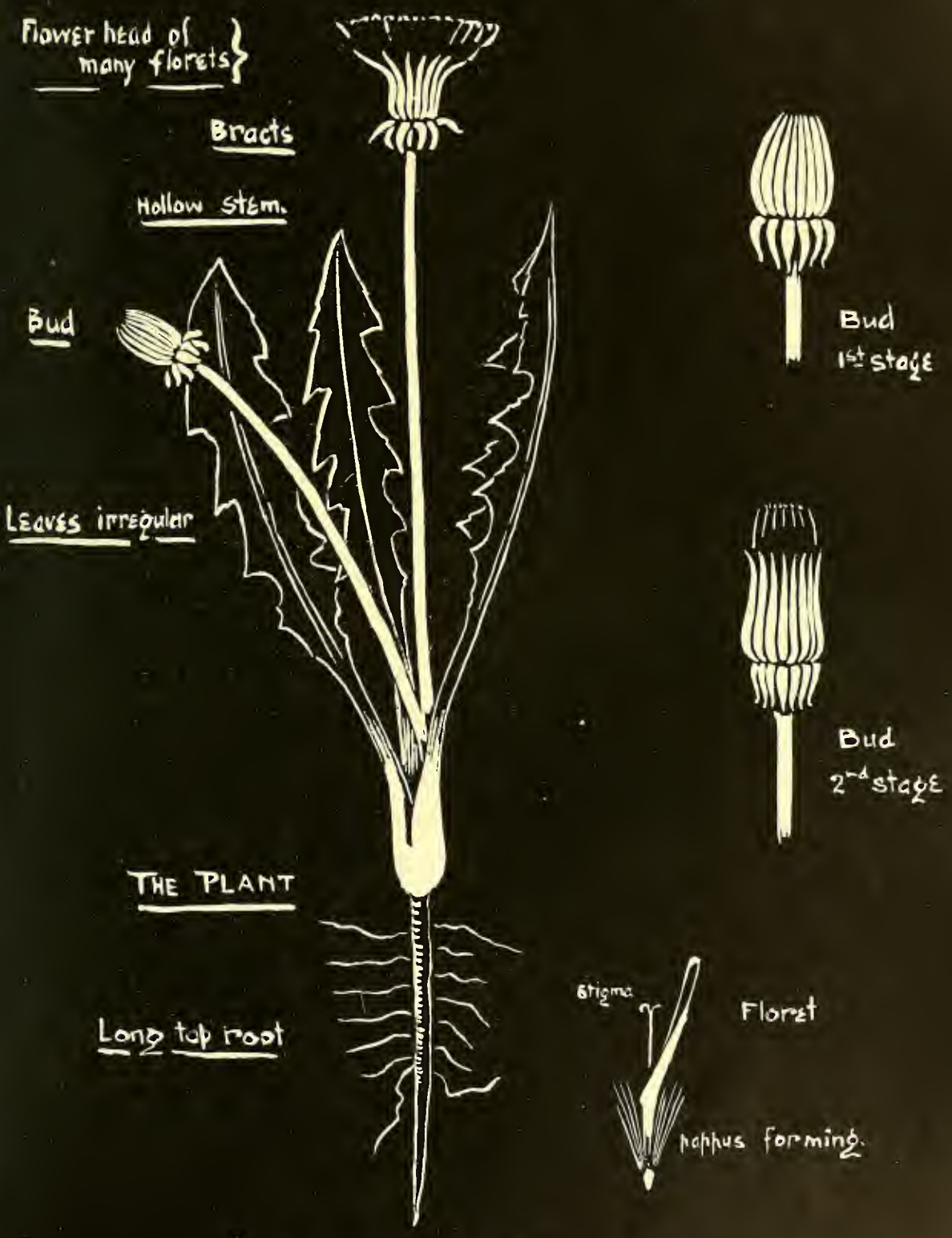
Specimens required :—Plants of Dandelion

Examine the plant, noting the following points :—

1. *Root system.*—Long dark-coloured tap root with root hairs.
2. *Leaves.*—Irregularly shaped leaves, giving name to plant (*dent-de-lion*). Observe rosette habit of outer leaves.
3. *Flowers.*—The stems are hollow and contain a milky juice. The flower is composed of numerous florets (note calyx and bracts).
   3*a*. *Florets.*—Examine with lens, noting the two curved stigmas which form the pappus with seed case at base.
4. *Fruit.*—The seeds are contained in a seed case to which is attached a pappus. Thus seeds are easily dispersed by wind (refer to "Wind Dispersal," p. 58).
5. *Habitat.*—Meadows and waste ground.

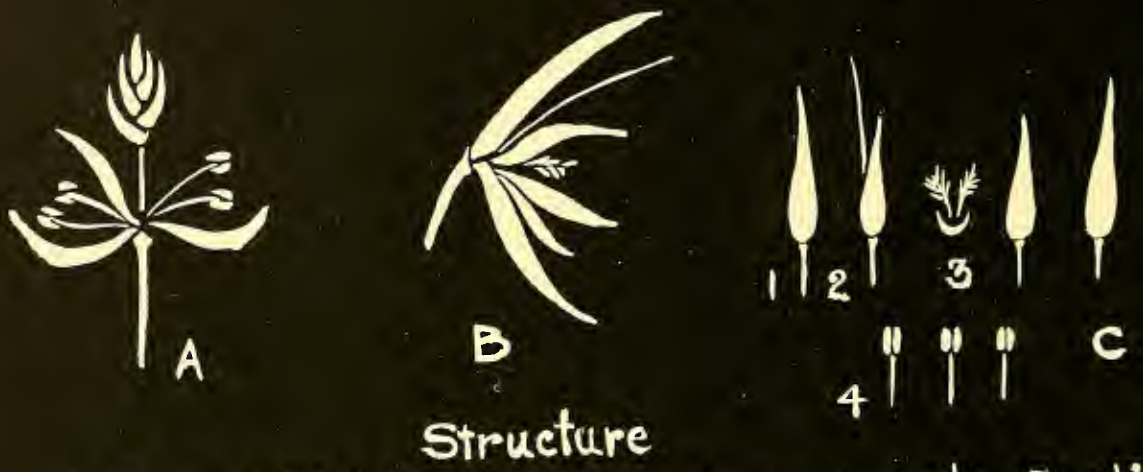
Proceed similarly with other members of the Composite family—*e.g.* Daisy, Sunflower, Cornflower.

THE DANDELION - FAMILY. COMPOSITES



{Taraxacum Officinale}

PLANT LIFE. GRASSES.



Structure

A, B – spikelets. C. 1. glume. 2. pale. 3. stigma. 4. stamens.

VIII. GRASSES

Specimens required :—Grasses in Bloom

Structure

Type.—Wild Oat Grass :—

(*a*) *Roots.*—Fibrous.

(*b*) *Stem.*—Note occurrence of joints (nodes). Make a section through grass, noting that stem is hollow between nodes and thus gives strength to the stem.

(*c*) *Leaf.*—Note parallel venation. Observe sheathing process of leaves at base.

(*d*) *Flower.*—Examine spikelet with lens.

1. Outer pair of leaves : the glumes.
2. Inner pair of leaves : the pales.
3. Stamens.—Note number.
4. Pistil with feathery stigmas.
5. Awn.

Note that glumes correspond to the sepals of a flower and that pales correspond to the petals of a flower.

Shake the head of the grass on paper, and note the yellow pollen. Pollination is effected by the wind.

Examine other kinds of grass in the same way, entering records and diagrams.

Obtain seeds of grasses and mount on cardboard with the grasses collected.

IX. FUNGI

Specimens required :—Mushroom, Fly Agaric

Structure

Examine Mushroom. Make a longitudinal section through cap and stem. Note thick fleshy stem with cap. Underneath the cap are coloured plates running from the centre to the edge of cap. These are the gills.

Spores

Cut a piece of white cardboard so that stem of Mushroom can just pass through and stand for a few hours in a tumbler. A collection of purple dust is thus secured. These are the spores, and should be examined under a strong lens or microscope. If the cardboard be previously covered with gum the spores may be preserved.

Reproduction by Spores

1. Place spores in a moist mixture of leaf mould and manure. Note formation of white threads—*viz.* Mushroom spawn (*viz.* the mycelium).

2. Obtain piece of spawn brick and grow in well-heated mixture. Note mode of growth of fungus, particularly (1) junction of cap to stem and (2) formation of ring on stem when fungus opens.

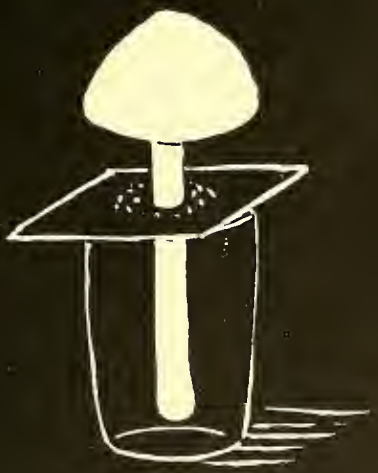
Study similarly the Fly Agaric (fungus with red cap flecked with white).

FUNGI

Mushroom

Fly Agaric.

Section of Fungus

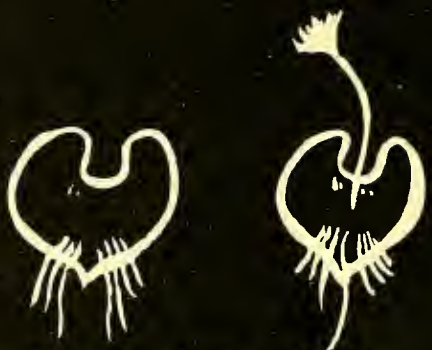


Collecting spores

FERNS.

Spore arrangement

Spore Enlarged



First growth

Fronds.

Hart's tongue.

X. FERNS

Specimens required :—Complete Plant of Common Fern

Structure

1. *Roots and Rhizome.*—Examine the underground portion of plant, noting the true roots and the underground stem—*viz.* the rhizome.
2. *Stem and Fronds.*—The stems bear fronds. Note mode of growth of young fronds.
3. *Fronds and Spores.*—Select a well-developed frond and examine underside. Regularly arranged clusters are observed. Examine under lens and note shape of clusters. These are the spores by which new plants are produced.

Reproduction by Spores

Prepare a shallow box filled with a mixture of rich loam, leaf mould, and sand. Smooth the surface and scatter ripened spores over it. Keep moist and cover with glass plate. Note the development of small fern plants.

Note.—If the spores be placed on a porous plate and are kept moist the development of the *prothallus* (or flat growth) may be observed.

XI. BUDS—ARRANGEMENT

Specimens required :—Twigs of Hazel, Oak, Ash, Lilac, Red Currant

Examine carefully the twigs of Hazel, Oak and Ash, noting the arrangement of the buds. Note the following :—

(*a*) *Ash.*—The buds are arranged opposite to one another.

(*b*) *Hazel.*—The buds are arranged alternately.

(*c*) *Oak.*—The buds are arranged on a spiral reaching from the apex of the stem to the base.

The types of arrangement thus represented are :—

1. Opposite arrangement—*e.g.* Ash.
2. Alternate arrangement—*e.g.* Hazel.
3. Spiral arrangement—*e.g.* Oak.

Collect other examples and classify on the lines indicated.

Mount specimens on cardboard divided into three sections.

Buds · arrangement.

I
ASH

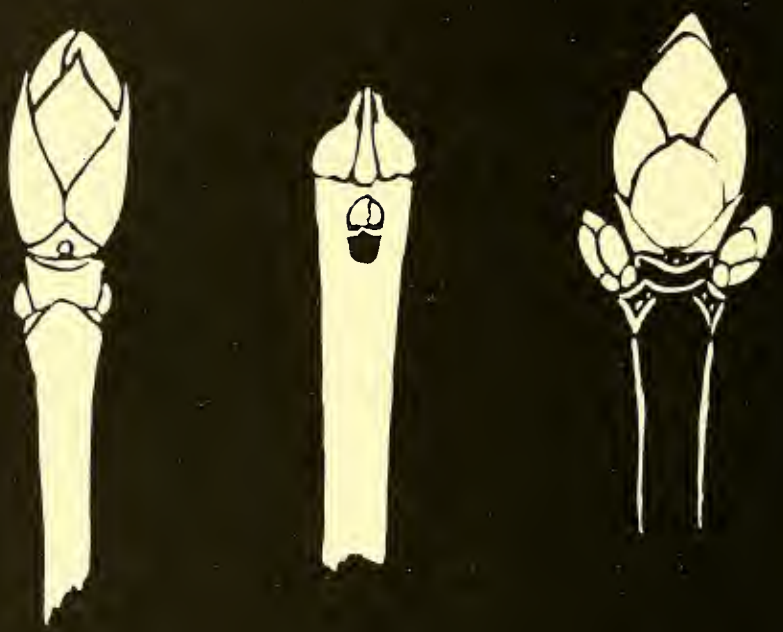
II
OAK

III
HAZEL

There are 3 Kinds of arrangements o
buds -viz

I. Opposite . e.g. ash
II. Spiral e g oak
III. Alternate e g hazel

Buds · { structure. / development



Sections

I. Sycamore II. Ash III. Horse Chestnut

{ Buds are protected by bud scales which overlap like tiles on a roof. In horse chestnut buds the scales are covered with sticky matter which protects the bud within. }

XII. BUDS—STRUCTURE AND DEVELOPMENT

Specimens required :—Buds of Sycamore, Horse Chestnut, Ash

(*February and March*)

Structure

Examine buds of Sycamore, Horse Chestnut, and Ash, noting particularly the bud scales. Note arrangement of scales—the best possible for protective purposes. Observe sticky matter on Horse Chestnut bud and note protective function. Remove bud scales and note silky hairs carefully shielding tender bud leaves within. Note leaf scar below bud. This is very clearly marked on the Horse Chestnut. Also observe ring of marks made by last year's terminal bud. This is a series of bud scale scars. Thus the amount of growth made by the stem in a year may be determined.

Cut sections through and across buds. Draw diagrams to record all specimens examined.

Note functions of bud scales :—

1. To maintain temperature within.
2. To prevent loss of moisture by evaporation.

Development

In April collect buds of the same trees. Examine carefully and note bud scales. These have burst open and turned backwards, subsequently dropping to the ground. Note growing part of bud, which will make new growth for the year. In November the buds present the first phase of development.

XIII. CATKINS—WIND POLLINATION

Specimens required :—CATKINS OF THE HAZEL

The Catkins with Stamens

Examine catkin of Hazel at the time of flowering. Note with a lens the structure of the catkin—*viz.* a collection of small flowers, each of which possesses stamens covered with pollen.

Pollen

Shake the catkins and note the shower of pollen dust. The same effect may be obtained by shaking a Hazel tree.

The Catkins with Pistils

Next examine carefully the flower of the Hazel and note crimson pistils. Note shape and contrast with catkins with stamens.

Wind Pollination

Observe a Hazel tree and note the large number of staminate catkins. These produce a large quantity of pollen, which is shaken out by the wind when the catkins open. Some of this falls on the pistillate catkin and fertilises it.

Examine catkins of Alder and Willow.

Hazel. catkins - wind pollination

THE TREE

catkin with stamens.

Catkin with pistils

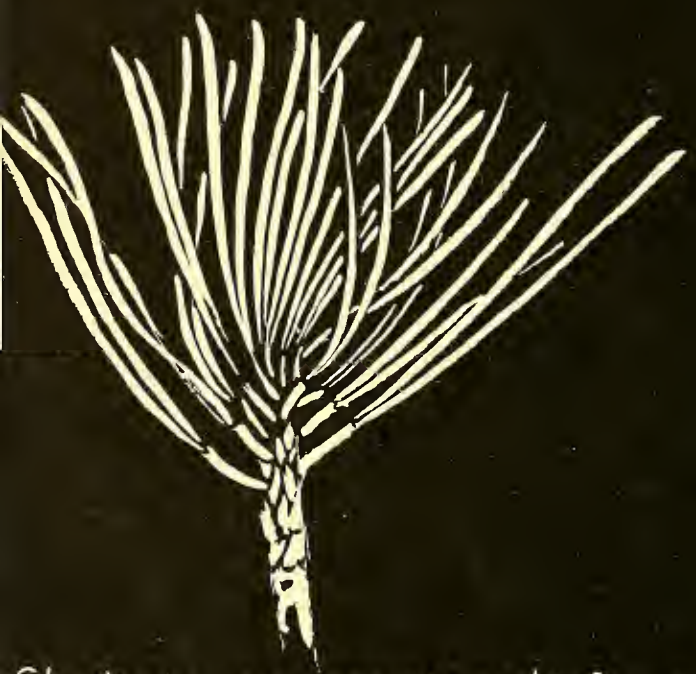
Flower of catkin showing stamens (enlarged)

The fruit

Hazel twig.

The hazel bears two kinds of catkins - -one with stamens the other with pistils.
The first kind produce pollen, which is shaken out by the wind. Some of the pollen finds its way to the pistils of the pistil bearing catkins.
Thus the hazel is fertilized by the wind.

Cone bearers - CONIFERS



Shoot showing arrangement of leaves

Needle leaves growing in pairs

Young Cone {catkin}

- The pine

The cone bearers are evergreens except in the case of the Larch.
The cones contain the seeds which are winged.
The leaves are of two kinds:- scaly leaves on the stem - needle leaves.
The wood is valuable.

XIV. THE TREE—Type, Conifers

Specimens required :—Branches, Cones of Scotch Fir, Catkins and Seeds

The Tree

Note :—

(1) Shape of tree : main trunk is tall and straight, shape of tree is conical.

(2) Mode of growth of branches : horizontal.

(3) Roots and nature of soil on which the tree grows.

The Leaves

Note two kinds :—

(1) Scaly leaves on branches.

(2) Needle leaves of the foliage. These grow in pairs.

Cones and Catkins

Note that the catkins with stamens are covered with pollen, which is shaken from the tree by the wind. The catkins with pistils receive pollen and form cones. The cones contain winged seeds which are dispersed by the wind when ripe. Collect cones and hang them up. Note subsequent opening of cone and flight of seeds.

Correlate with lessons on Wind Pollination and Dispersal of Seed by Wind.

Examine other trees on similar lines.

Refer to Part III. : Relation of Plant Life to the Soil (p. 56).

PART II.—ANIMAL LIFE

A. INSECT LIFE

I. LIFE HISTORY OF THE SCALY-WINGED INSECTS

Specimens required :—Caterpillars, Chrysalides. Common Butterflies, and Moths

Structure

Examine perfect insects. Note :—

(*a*) *Head.*—Bearing antennae, tube, eyes. Note function of each organ.

(*b*) *Thorax.*—Bearing three pairs of legs and two pairs of wings.

(*c*) *Abdomen.*—Made up of segments.

Take a little dust from wings and examine under microscope, noting *scales*. The scales vary in shape and give the name of Scaly-winged Insects to this group.

Life History

The life history of this highly interesting group should be studied by observing the development of the egg or the caterpillar. These are easily collected. The caterpillars should be fed on their natural food plant.

Note and record the following important points :—

1. Appearance of larva from egg.
2. Change of skin at intervals.
3. Change to chrysalis.
4. Change to perfect insect.

Various species may be fed, and the following observations should be made :—

1. *Ova.*—Shape. Where found. Date of discovery.
2. *Larva.*—Colour. Food plant. Date of emerging from egg.
3. *Pupa.*—Colour. Size. Shape. Where placed. Date of forming. Presence of cocoon.
4. *Perfect Insect.*—Date of emergence.

The following are interesting species for observation :—

1. *Tiger Moth.*—The larvae are found on hedge sides in spring, feeding principally on dock.
2. *Oak Eggar Moth.*—The larvae may be taken on grass in April. The pupa is placed in a hard cocoon.
3. *Emperor Moth.*—The larvae feed on heath in summer. The cocoon is constructed of silk.
4. *Pale Tussock Moth.*—The larvae are found principally on the hop in late summer. The cocoon is placed on the ground.
5. *Peacock Butterfly.*—The larvae feed on nettles in spring. The chrysalis is suspended.
6. *Red Admiral Butterfly.*—This larvae may be found in colonies on nettles in summer. The chrysalis is suspended.

LIFE HISTORY OF THE SCALY-WINGED INSECTS.

Fig 1.

Fig 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7.

Fig. 8.

Fig. 9

Fig. 10.

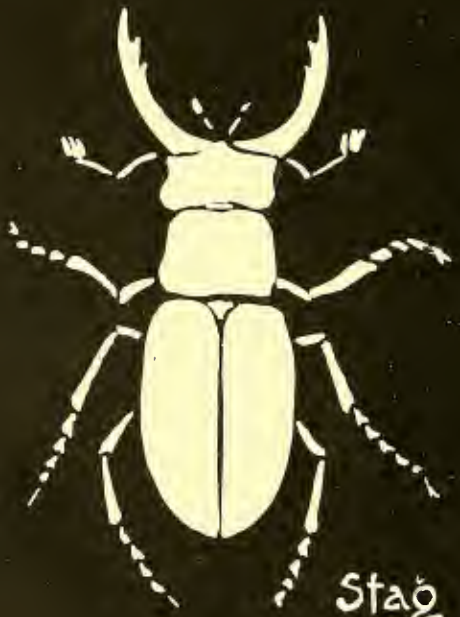
Fig 1. Larva of Hawk moth
Fig. 2. Diagram of larva showing segments
Fig. 3 Diagram of pupa " "
Fig. 4. Pupa of Privet Hawk moth.
Fig. 5 " " Currant moth.
Fig 6 " " White Butterfly.
Fig 7 Cocoon of Emperor Moth in heather.
Fig. 8 Section of cocoon
Fig 9 Cocoon of Oak Eggar moth.
Fig 10. Pupa case of Burnet moth.

WING CASED INSECTS.

Cock chafer

Rose beetle

Dor beetle



Stag beetle

Female stag beetle.

Typhæus

Typhæus showing wings

Ladybird (enlarged)

II. WING-CASED INSECTS

Specimens required :—Stag Beetle, Cockchafer, Ladybirds, etc.

Type for study.—Stag Beetle

Structure

Examine these insects and note three divisions—*viz.* :—

(*a*) *Head.*—Bearing horns, antennae with leaf-like plates.

(*b*) *Thorax.*—Bearing one pair of legs. Note jointing and three joints of leg. The third joint is adapted for clinging purposes.

(*c*) *Abdomen.*—Bearing two pairs of legs underneath, two pairs of wings above.

Note the wing cases and their protective function.

Types

Study in similar manner members of the following groups—*viz.* :—

(*a*) *Ground Beetles—e.g.* Wood Tiger Beetle, Violet Ground Beetle.

(*b*) *Rove Beetles—e.g.* Devil's Coach Horse.

(*c*) *Carrion Beetles—e.g.* Burying Beetles, Pill Beetles (these feign death when touched).

(*d*) *Chafer Beetles—e.g.* Stag, Cockchafer, Rose Beetle, Dor Beetle.

(*e*) *Ladybirds.*—Their larvae are found principally on rose bushes ; they feed on many species of Aphis (*see* Useful Insects).

Correlate with lessons on—

(*a*) *Harmful Insects—e.g.* Stag Beetle, Cockchafer.

(*b*) *Useful Insects—e.g.* Carrion Beetles, Ladybirds.

Note.—The Tiger Beetle forms a most interesting study in connection with Life on the Common. The pugnacious larva may be sought for in its small tubular retreat. The perfect insect is a well-known inhabitant of the warm sandy banks of our southern commons.

III. TRANSPARENT-WINGED INSECTS

Specimens required :—Dragon Fly, Wasp, Bee, Gnat

Type :—Bee

Structure

Note three divisions characteristic of insect structure :—

Head.—Eyes, antennae. Note functions.

Thorax.—Bearing two pairs of membranous wings and three pairs of legs. Note structure of legs.

Abdomen.—In segments. Note sting and defensive function.

Habits

Gregarious nature. Honey seekers. Note their highly intelligent habits. Correlate with fertilisation of flowers by insects.

General

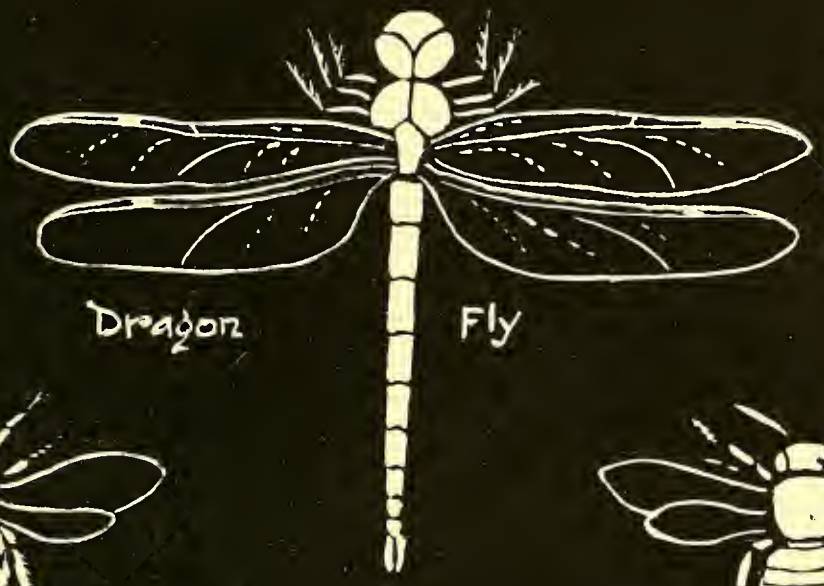
1. Life history is well illustrated by Dragon Fly, whose larvae and pupae may be taken from ponds. (Note protective resemblance of larva of Caddis Fly.)

2. Note carnivorous habit of Wasp and its nest-making power.

Study in similar way the structure of Hornet, Wasp, Dragon Fly, and Ant.

Note.—The life history of this class of insects may be studied in detail in most stagnant ponds during May. Probably the best hunting ground is a water tank. Here may be observed the Gnat's raft of eggs, the wriggling larvae, and the pupae. Numbers of Gnats may be seen escaping from the pupae case, and the latter may be collected and preserved in spirit. In August the emergence of the Dragon Fly from the pupal case may be observed on the banks of ponds and streams. The pupa case or nymph case may be found in August and September clinging to the reeds and rushes on the sides of ponds and ditches.

TRANSPARENT WINGED INSECTS



Dragon Fly

Humble Bee

Leaf cutter Bee

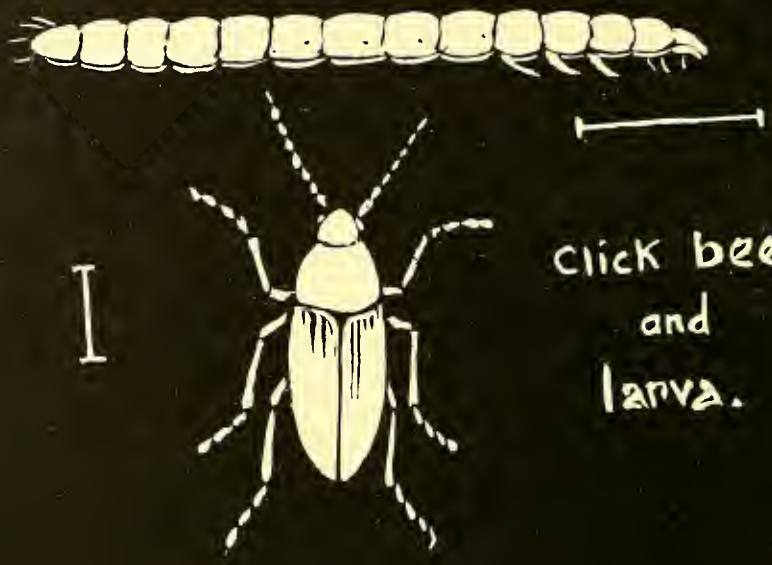
Leaf cut by Bee.

Hornet

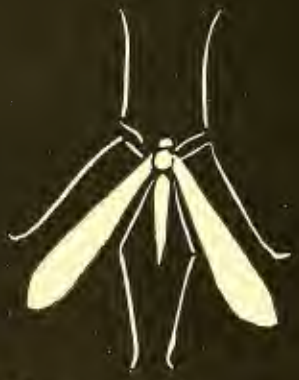
Wood Ant.

Worker ant.

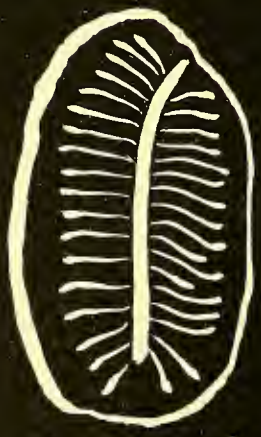
Harmful Insects



Click beetle and larva.



Crane Fly



Borings of grub of Beetle in bark

Grub of Chafer beetle

Larva of Goat Moth
(wood eater)

IV. HARMFUL INSECTS

Specimens required :—

1. Pine Bark showing Beetle Burrowings
2. Larva of Goat Moth.
3. Wireworms and Click Beetles
4. Grubs of Chafer Beetles

1. Burrowing Beetles

Note bark eaten out by beetle grubs. Notice the main gallery and smaller ones leading from it. Observe small holes showing place of exit of beetle after the change from the grub. Eggs are laid at intervals along the main gallery, and the grubs eat outward. Note reason—*viz.* so that each receives a full supply of food.

2. Wood-boring Larvae

Note structure of Goat Moth larva, especially noting its strong jaws. Observe that it feeds on wood. Since it spends several years in the larval state it causes enormous injury to tree life. Another good example is the Leopard Moth larva.

3. Wireworms

These may be obtained from infested land by trapping them in a potato tuber. Note segments and tenacious build of the worm, which is really the grub of the Click Beetle. The Wireworm causes great damage to roots. Other examples of root-eaters are the larvae of Cabbage Moth.

4. Beetles

Note grub of Cockchafer Beetle. It possesses powerful jaws, which cause great damage to roots. Observe the jaws of the beetle, which is well known for the great harm it does to foliage.

Refer to *Injurious Larvae* (p. 58).

B. SHELL LIFE

V. LAND AND FRESH-WATER SHELLS

Specimens required :—

Common Snails (*Helix aspersa, H. hortensis*)
Pond Snails (*Limnea stagnalis, L. peregra*)
Coil Shells (*Planorbis*)
River Mussel (*Anodon cygnea*)
Live Specimens of Snail and Slug

Structure

Note the shape and mode of growth of the shell. This is well shown in section. Note smooth nacreous layer inside the shell so that the soft body of the inhabitant is completely protected. The application of weak acid to the shell indicates that it is largely composed of carbonate of lime.

Examine the live specimens and distinguish the fleshy foot and head. Note also the slimy state of the outer skin. The strong muscular system of the snail and slug may be well observed if the specimen be placed in a glass jar.

Habits

The land shells are mostly nocturnal, and are vegetable feeders. They are provided with ribbons of teeth.

Obtain hibernating specimens in order to observe the protective covering of hardened slime, and also the breathing aperture.

The pond snails should be studied in the school aquarium, in which they are useful scavengers. They remove the green growth (confervae) from the glass sides of the aquarium. This operation should be studied with a lens.

Other interesting but less common species are furnished by—

(*a*) The Trap-door Snail (*Clausilia*), which is to be found on tree trunks in summer—usually Beech.

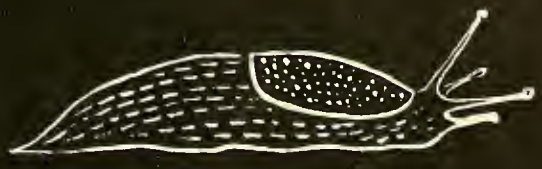
(*b*) The Round-mouthed Snail (*Cyclostoma*), which frequents chalky districts. It is provided with a door (*Operculum*).

Land & Freshwater Shells.

Land snails

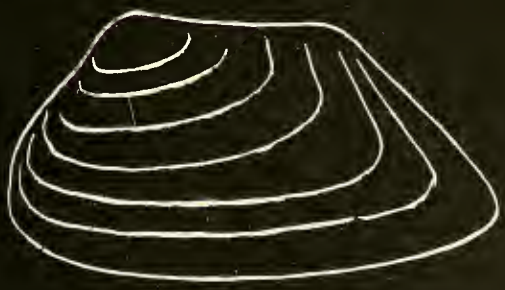
Clausilia (found on trees)

Snail - Helix



Slug - Limax

Planorbis

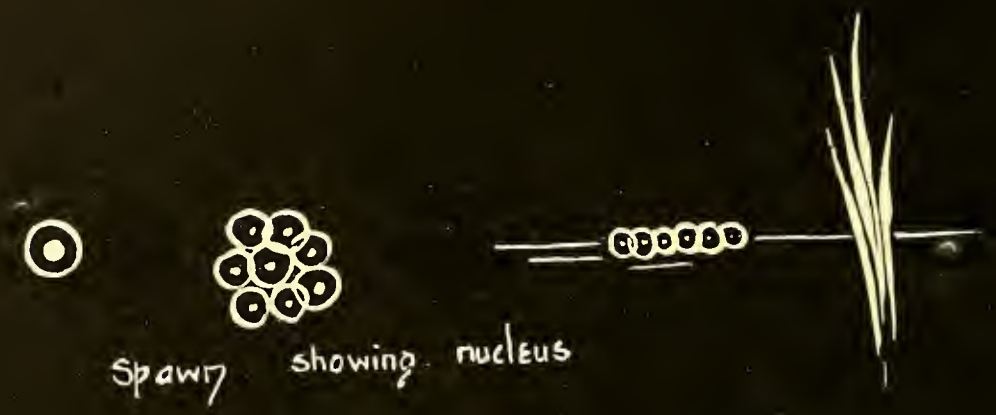


Swan mussel

Pond snails

Shells of slug.

LIFE HISTORY OF FROG



Spawn showing nucleus

Stages in development of tadpole

Frog

C. AMPHIBIANS

VI. LIFE HISTORY OF FROG

Specimens required :—Spawn and Tadpoles in Aquarium

Development

In early spring obtain spawn and place in convenient vessel. Make the following observations :—

1. Change of spawn to the embryo.
2. Change of embryo to tadpole.
3. Vegetable food of tadpole.
4. Appearance of hind legs.
5. Appearance of fore legs.
6. Disappearance of tail.

Make diagrams representing the various stages, and record dates of change in phase of development. Note structure of frog, observing—

1. Tongue, which is adapted for insect catching.
2. Breathing process, resembling action of bellows.
3. Webbed feet adapted for swimming.

D. BIRD LIFE

VII. STRUCTURE OF BIRDS

Specimens required :—Skeleton of Bird and Bones to show Structure of Neck and Legs

Structure

Note :—

1. *Head.*—Note beak and absence of teeth.
2. *Neck.*—Observe numerous neck-bones, giving freedom of movement.
3. *Breastbone.*—With strong keel to which wing muscles are attached.
4. *Feet.*—Contain many small bones, giving freedom in clasping.

The large bones are hollow. Note combination of conditions to produce strength and lightness.

Feather.—Note structure of larger feathers—*viz.* barrel, axis with vanes on either side.

Note wing structure and feather arrangement.

STRUCTURE OF BIRDS.

TYPES OF BIRDS

Eagle

BIRDS OF PREY

Eagle

Woodpecker

PERCHERS

Golden crested wren

Pigeon

SCRAPERS

Pheasant

Lapwing

WADERS

Heron

Moorhen

SWIMMERS

Duck.

VIII. TYPES OF BIRDS

Outlines of Lessons

Birds of Prey

The birds of this class possess strong beaks, keen vision, and powerful claws. Their nests are generally in inaccessible positions, and are more or less carelessly constructed.

Perchers

These birds possess claws especially adapted for grasping branches. One toe is directed backwards. Many are good songsters, and most of them build beautiful nests.

Scrapers

These birds are vegetable feeders, and the majority scratch the soil for food. Their nests are generally placed on the ground.

Waders

These are inhabitants of marshes. They possess long legs, long necks, and lengthy bills. Their nests are usually hidden in rushes.

Swimmers

These birds have webbed feet, short and powerful legs. Their nests are rudely constructed.

EAGLE

BIRD OF PREY

WOODPECKER

PERCHER

IX. TYPES OF BIRDS

Birds of Prey

Although there is little opportunity of studying the members of this class of birds in their natural state, yet they present most interesting material for lessons on bird life, especially in reference to their highly adaptive features. Stuffed specimens, where obtainable, are valuable aids, yet in most instances the teacher must resort to pictures and photographs.

The chief birds of prey are the Eagles, Hawks, and Owls. In each example the points to be noticed are :—(*a*) Strength of beak and claws ; (*b*) keen vision ; (*c*) rapidity of movement. In the case of the Owls the most interesting points are :—(*a*) Nocturnal habits, and (*b*) noiseless flight.

The Sparrow Hawk is a widely distributed bird, and may be observed in many districts.

Perchers

These embrace a large number of birds, and there are numerous examples in every district. Their claws are especially adapted to grasping branches. Our finest singing birds are found among these types. Useful examples for study are the Woodpecker, Thrush, Tits, and Finches. The nests of the last three are beautifully constructed.

X. TYPES OF BIRDS

Swimmers

The swimmers are local in their distribution, and the most typical specimen for study is the Duck. The Moorhen is a fairly common wild type. The important points are: (*a*) Short and strong legs; (*b*) webbed feet; (*c*) bills adapted for feeding in water.

The nests of these birds are generally rudely made, yet they are securely placed in rushes.

Scrapers

This class of birds is well illustrated by the Chicken. They usually possess sharp, strong claws, and their food is mostly of a vegetable nature. Their nests do not indicate any great care, and are usually placed on the ground. The Pheasant and Pigeon are members of this class.

Waders

The waders are mostly confined to the marshes except during severe weather, when they are driven inland for food. The Heron is a useful type—*viz.* it possesses lengthy legs and neck. The Lapwing, although its outward appearance does not indicate that it is a wader, is a most interesting bird, and may be observed in most districts throughout this country.

Bird Types.

Swimmer

Moorhen

Pheasant

Scraper (Gallinæ)

PART III

OUTLINES OF SUGGESTED LESSONS

The following suggestions are presented as being especially adaptable to senior class work.

1. Relation of Plant Life to the Soil

This subject provides an interesting series of observational lessons and deals with the distribution of plants according to the character of the soil. This primarily depends on the geological structure of the district, and few are so peculiarly favoured that the characteristic flora of more than one or two soils may be studied. The Orchis, Thistle and Beech are indications of a chalky soil; Heather, Gorse and Firs invariably grow on sandy areas; while clay soils yield the Primrose, Coltsfoot and Oak in profusion. Many other plants may be added to these small lists.

2. Relation of Plant Life to Insect Life

The study of this relation introduces the student to the subjects of fertilisation of plants and injurious insects. The subject also follows the preceding lesson in logical sequence.

In reference to fertilisation the work of the butterflies, moths, bees, flies and beetles is widely known. Good subjects for observation are the Primrose, Violet, Pansy and Wild Arum. There is a two-fold phase to this study, *viz.*:—

1. The specialised structures of flowers in order to secure fertilisation.
2. The usefulness of insects and their adaptive structures to secure food from the flower.

As an example of an insect-destroying plant the Sundew forms an interesting subject.

3. The Habitat of Plants

This subject is nearly related to 1, except that the underlying conditions of growth are more complex and not purely geological. Hence more specialised study is essential. The important influences to be observed are moisture, sunlight, aspect of situation and character of soil. These involve observations of the following:—

Marsh plants.
Riverside plants.
Hedge-side plants.
Moorland plants.
Woodland plants.
Meadowland plants.

4. Climbing Plants

Probably this subject is of the greatest observational value, since it provides many experiments on plant growth. It also definitely illustrates the power of plants to adapt themselves to environment. Certain plants will grow to a great height when prevented from developing naturally by undergrowth, although these plants are not naturally climbers. Good examples are afforded by Bracken and Toadflax. The development of tendrils is an interesting subject. The important features are :—

1. *Twining plants.*—Direction of twining.
2. *Tendrils.*—The specialised leaf-stalk tendril of the Fumitory. The highly developed spiral tendril of the White Bryony. The clinging tendril of the Pea. The tendril of Virginia Creeper.

5. Parasitic Plants

The Mistletoe is generally accepted as the stereotyped illustration of parasitic plants, yet the Dodder is far more interesting. The Broom-rape is probably less conspicuous. Many fungoid pests of the garden provide interesting microscopic studies and also a means of correlating Nature-study with the school garden. Lessons may be based on the following outlines, *viz.* :—

1. *Dodder* (*Cuscuta*).—This germinates in the soil and then forms a parasite on Ling, Clover, etc. The dodder thrusts haustoria into the tissue of the host plant, and thus secures its food. Note reason for absence of leaves.
2. *Mistletoe.*—This well-known parasite germinates in crevices in the bark of its host. Haustoria are worked into the tissue of the tree, and thus the parasite is sustained.
3. *Broom-rape.*—This is parasitic upon roots of trees.
4. *Fungi.*—Numerous instances of these abound in the form of garden pests.

6. Protection in Nature

No attempt will be made here to treat in one lesson or many this most extensive subject. The study of Nature's protective adaptations is of the highest interest and of peculiar educational value. The following outlines are suggestive of a series of lessons on protective forms to be observed in insects only :—

(*a*) *Protective shape—e.g.* (1) the stick caterpillars, *viz.* Brimstone Moth, Swallowtail Moth ; (2) Caddis cases.

(*b*) *Protective colouring—e.g.* (1) the caterpillars of the Poplar Hawk Moth, Eyed Hawk and Privet Hawk Moths are leaf-green in colour, and hence difficult to detect ; (2) the colouring of the perfect insect often harmonises with its surroundings—*e.g.* the Peppered Moth, the Waved Umber.

(*c*) *Protective habits.*—(1) Many insects feign death—*e.g.* the Click Beetle. (2) Many caterpillars feed at night, and others keep to the underside of the leaf. (3) Some caterpillars are gregarious in the early stage of growth and protect themselves by forming a tent of silken threads—*e.g.* the Lackey Moth caterpillar.

7. Dispersal of Seeds

This provides several interesting lessons for the autumn. The chief outlines are :—

1. *Mechanical dispersal—e.g.* Pea, Bean.
2. *Wind dispersal—e.g.* (1) winged seeds—*e.g.* Sycamore ; (2) feathered seeds—*e.g.* Thistle.
3. *Animal agents—e.g.* clinging seeds of Burdock and Goosegrass.

8. Useful Insects

The following list contains the common, and therefore easily obtainable, specimens for lessons on this subject.

Ichneumons.—The larvae are parasitic upon the caterpillar and pupa of the white butterflies.

Honey-bee, Bumble-bee.—The perfect insects fertilise plants while gathering honey.

Ground Beetle.—This devours snails and insects.

Tiger Beetle.—The larva and perfect beetle eat insects.

Ladybird.—The larvae of this beetle devour Aphides.

Devil's Coach-horse.—This eats moths and insects generally.

Centipede.—This feeds on insects.

Lacewing Fly.—This devours Aphides.

9. Injurious Larvae

1. *Brindled Beauty Moth caterpillar.*—The eggs of this moth are placed on fruit trees. The caterpillars may be found in June and July.
2. *Codlin Moth caterpillar.*—The eggs are laid in the eye of the apple, and the larvae eat into the fruit.
3. *Goat Moth caterpillar.*—The eggs are placed in crevices in the bark of Willow, Poplar and other trees. The caterpillar destroys the tree.
4. *Currant Moth caterpillar.*—Larvae are found on currant and gooseberry bushes.
5. *Lackey Moth caterpillar.*—These are fruit pests.
6. *Winter Moth.*—The wingless female ascends the tree, and the male may be taken in December.

COLLECTING AND PRESERVING SPECIMENS

CLASSIFIED collections of specimens are of great value in Nature-teaching, and provide records of observations and a useful store of illustrations for future work.

Collecting specimens presents no great difficulty, yet it must be carefully directed, or it may degenerate into indiscriminate and promiscuous destructiveness. Neither is it difficult to preserve specimens, except, perhaps, in the case of fungi and a few of the Neuroptera.

Flowers, ferns and grasses should be well dried before they are placed in folios. This is usually secured by pressure. The most important point is that each specimen or set of specimens should be accompanied by full particulars as to name, family, habitat and date of flowering. This work usually occupies the summer months, and in the autumn the seeds and seed-cases of plants already collected should be added to the collecting folio. Roots should not be overlooked, and so typical life-histories are developed. In March and April specimens of buds may be secured. These are generally coated with varnish before being arranged on suitable wall-cards.

The fungi present trouble on account of their peculiar fleshy structure. Some of the puff-balls may be dried, yet the most satisfactory procedure is to make drawings of the specimens as they are collected in September, October and November. The preservation of the insects is very interesting work and generally presents little difficulty, yet demands much care. The collecting of butterflies and moths must, of course, be conducted on practical entomological lines, and indiscriminate collecting cannot be too forcibly deprecated. The preservation of ova is simple, but larvae present some difficulty, especially in the case of the large types. They may be stuffed or placed in spirit, and notes on procedure in both cases may be found in those manuals devoted to entomology.

The beetles are rather easy to deal with. Type specimens alone are necessary. The medium-sized beetles are fixed by means of pins through an elytra, while the smaller varieties are gummed on cards.

In the case of the nerve-winged insects some amount of careful handling is essential. They are treated in the same manner as the butterflies and moths. The dragon fly needs special attention, or careless storage may lead to disappointment.

Shells of land and fresh-water types are obtained by removing the inhabitants after immersion in boiling water. Entire specimens of these and the slugs are easily preserved in spirit.

Arrangement of Specimens

The storage of specimens in a way suitable for lesson illustration is not a simple matter. The cupboard museum is, generally speaking, inconvenient both as a means of storage and display of specimens. Wall-cases are undoubtedly far superior, in that they are always in sight and allow of logical and scientific classification. Such cases may be constructed 3 feet by 2 feet and from 3 to 6 inches deep, and if movable backs be provided their use is greatly increased.

The classification of specimens is of the greatest importance. Hard and fast scientific classification is often complicated, and generally confusing. In the following arrangement objects may be classified so that their relationship may be clearly defined and emphasised, *viz.* :—

Life in the Woods

1. *Plant life.*—Woodland flowers : Primrose, Anemone, Violet. Woodland trees : specimens of bark, leaves and fruit.
2. *Animal life.*—Drawings and photographs of woodland birds and nests. Specimens of eggs. Woodland insects.

Insect Life

1. *Scaly-winged insects.* — Common butterflies and moths ; *viz.*, ovum, larva, pupa, imago.
2. *Wing-cased insects.*—Common beetles. Evidences of the work of boring beetles.
3. *Transparent winged insects.*—Bees, Wasps, Dragon Flies, Gnats.

(*See* Frontispiece for illustration of an arrangement of specimens of insect life.)

OBSERVATIONS AND RECORDS

In this section we are face to face with the most important work in Nature-teaching, *viz.* in selecting salient points for observation and their faithful recording. Promiscuous and wholesale listing of observances is worthless and bewildering, and only helps to veil the ultimate of the true Nature-teacher. In this respect we are concerned with Nature only so far as it provides us with phenomena that tend to educational advantage, and it rests with our own powers of perspicacity whether the phenomena we select are of educational value or not.

Naturally, the observations vary with the locality, yet at the same time it is possible to define phenomena that are widely distributed, remembering that it is of greater advantage to record a few phenomena accurately than to compile lists of observances without any attention to underlying conditions.

Probably the most valuable records are those of the first appearances of flowers, insects and migrants. At the same time, due attention must be paid to the keeping of a weather record so that a fairly accurate relationship between meteorological conditions and these appearances may be established.

The following are suggested :—

(*a*) *First appearances of flowers.*—Hazel, Coltsfoot, Wood Anemone, Blackthorn, Garlic Hedge Mustard, Harebell, Primrose, Hawthorn, and Horse Chestnut.

(*b*) *First appearances of migrants.*—Swallow, House Martin, Cuckoo, Nightingale, Wryneck, Flycatcher, Fieldfare, and Redwing.

(*c*) *First appearances of insects.*—Honey-bee, Wasp, Small White Butterfly, Orange Tip Butterfly, Meadow Brown Butterfly, and Red Admiral.

The above list contains widely distributed forms only, and, if records of these are kept from year to year, interesting and valuable results may be secured. At the same time, observations of interest should be recorded—*e.g.* appearances of rare birds, rare insects, or the discovery of rare flowers.

With the recording of observances is closely allied the survey of the district from the Nature-teaching point of view. This involves the compilation of lists of flora and fauna types. Yet the work does not rest here, for the survey must establish relationship between soil and flora, between flora and fauna ; and so the task is an aid to a complete correlation between Nature-teaching and Physical Geography. The ordnance map is invaluable here, and by means of school rambles a most

interesting vista of study is opened up to the teacher and the scholar. The character of the work, its scope and application, is dependent upon the nature of the locality to be surveyed, but generally the procedure may be :—

1. *The soil and physical features of the district.*
2. *Tree life.*—Kinds of trees and their distribution.
3. *Plants.*—Kinds and distribution studied with due attention to habitat.
4. *Animal life.*—Studied in the spirit indicated in the general scheme of this book.

NATURE CALENDAR

In this calendar widely distributed species only are indicated. Appearances depend mainly on meteorological conditions, hence some appearances may be observed earlier or later than given here. The selection of these has been guided by an endeavour to indicate observations especially suitable for Nature-teaching requirements.

January

Insects.—Hibernating butterflies appear on sunny days. The chief moths of this month are the Winter Moth and Spring Usher. The former of these flies at night in the early part of January, and the latter may sometimes be secured at rest on palings and tree-trunks during the day. Pupae of many species are to be found either in the soil or safely ensconced in crevices.

February

Flowers.—The Daisy, Coltsfoot, Red-Dead Nettle, Groundsel, and Butcher's Broom are generally in blossom.

Trees.—Good specimens illustrating the formation of winter buds are now obtainable.

Insects.—On warm days hibernating butterflies may be observed, and the most conspicuous of these is the Brimstone.

March

Flowers.—Wood Anemone, Lesser Celandine, Violet, Marsh Marigold, Dandelion, White Dead Nettle.

Trees in blossom.—Hazel, Alder, Elm, Poplar, Aspen, Elder, Yew, Blackthorn.

Insects.—A few larvae commence feeding this month and may be obtained from their respective food plants. Butterflies appear, *viz.* Large White, Small White, Green Veined White. The Early Grey, Early Thorn, and Engrailed are the chief moths. Ladybirds and water-beetles appear.

Birds.—Song-birds now commence singing. Rooks repair to their nesting trees. The Wheatears arrive, and some early builders select sites for breeding.

April

Flowers.—Mouse-tail, Garlic Mustard, Buttercup, Common Vetch, Cuckoo Flower, Wood Strawberry, Stitchwort, Wood Sorrel, Primrose, Wild Arum, Dog Violet, Chickweed.

Trees in flower.—Birch, Osier, Hornbeam, Ash, Larch, Oak, Box.

Trees in leaf.—Elm, Lime, Beech, Horse Chestnut, Sycamore.

Insects.—Many larvae are now feeding, and the most conspicuous of these is the larva of the Tiger Moth. Several butterflies are flying, *viz.* Orange Tip, Small Copper and Holly Blue. The Brimstone and Waved Umber represent the moths. Queen wasps proceed to select nesting sites, and bees commence work on warm days. Ants and spiders are in evidence.

Birds.—The feathered types are busy this month. The Wryneck, Cuckoo and Nightingale arrive.

May

Flowers.—Clover, Water Crowfoot, Birdsfoot, Bulbous Buttercup, Fumitory, Shepherd's Purse, Red Campion, White Bryony, Charlock, Heartsease, Ragged Robin, White Campion, Greater Celandine, Sorrel, Bogbean, Pennywort, Scarlet Pimpernel, Plantain, Black Bryony, Broom, Orchis, Bluebell, Forget-me-not.

Trees in leaf.—Blackthorn, Wild Cherry, Alder.

Trees in flower.—Edible Chestnut, Sycamore, Pine, Rowan, Holly, Briar, Honeysuckle, Buckthorn, Hedge Maple, Traveller's Joy.

Insects.—Larvae are abundant. New species of butterflies appear, *viz.* Wall Butterfly, Small Heath, and Common Blue. Among the moths are noticed the Pale Tussock, Emperor, and Puss. Dragon Flies haunt streams and ponds, and the Chafer Beetle flies at evening.

Birds.—This month brings the Fly-catcher, Red-backed Shrike and Nightjar to the southern and south-western counties.

June

Flowers.—Rest-harrow, Hedge Mustard, Common Agrimony, Corncockle, Hemlock, Meadow Rue, Spearwort, Poppy, Mignonette, Milkwort, Mallow, Meadow Cranesbill, Dove's-foot Cranesbill, Trefoil, Herb Robert, Meadowsweet, Pennywort, Common Avens, Sowthistle, Ragwort, Viper's Bugloss, Yellow Toadflax, Goosegrass, Woody Nightshade, Deadly Nightshade, Foxglove, Milk Thistle, Heather.

Grasses in flower.—Barley Grass, Cocksfoot, Timothy Grass, Wild Oat Grass, Fescue Grass, Tufted Hair Grass, Quaking Grass, Couch Grass.

Trees in flower.—Guelder Rose, Privet, Dog Rose, Blackberry.

Insects.—Larvae are generally abundant. Butterflies are now numerous, the chief being the Small Tortoiseshell, Meadow Brown, and Large Skipper. Among the moths the chief forms are the Privet Hawk, Eyed Hawk, Cinnabar, and Buff Tip.

July

Flowers.—Fennel, Fool's Parsley, Willow Herb, Sundew, Dodder, St. John's Wort, Purple Loosestrife, Bog Pimpernel, Wood Sage, Harebell, Bog Asphodel, Teazle.

Trees in flower.—Lime.

Insects.—Larvae are extremely abundant. Butterflies are numerous, *viz.* Brimstone, Painted Lady, Grayling, Large Heath, Ringlet. Moths are abundant, *viz.* Tiger, Ermine, Goat Moth, and Oak Eggar.

August

Flowers.—Few new varieties come into blossom this month, and most of those given under June and July continue in flower.

Trees are now in full foliage.

Insects.—Many butterflies of the preceding month are on the wing. Moths are still abundant. Interesting larvae are now obtainable, *viz.* Privet Hawk and Emperor.

September

Flowers.—Several of the preceding month's blossoms are to be noted. Interesting material for lessons on seeds and seed-dispersal may be secured. Fruits appear on the Hazel and Bramble. Fungi appear.

Insects.—Insect life is now on the wane. The larvae of the Fox Moth and Pale Tussock may be secured on their food plants.

October

Flowers.—A few plants continue in bloom. Fruits and seeds generally are obtainable. Fungi are abundant. Leaf-fall commences.

Insects.—The Red Admiral and Peacock are now on the wing, and frequent gardens on sunny days. Hibernating larvae commence to take up winter quarters.

November

The trees are now bare, and reveal characteristic shapes and modes of growth. Fungi are yet to be found. The seed cases of the Beech and Horse Chestnut provide subjects for study.

December

Insects.—The December Moth is on the wing, and winter gnats abound.

Birds.—Winter visitors arrive this month if the weather be at all severe. The chief of these are the Scandinavian Thrushes, *viz.* Fieldfare and Redwing. Many birds of retiring habits are driven in for food.

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